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In Space Assembled Telescope (ISAT) Study Preliminary Findings

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"When is it advantageous to assemble telescopes in space rather than deploying them from launch vehicle fairings"? This question forms the crux of the objectives of a NASA study we have been conducting in collaboration with colleagues from different NASA centers, industry and academia. In this study, we have engaged a broad cross section of experts from the various fields of optics engineering, that is, telescope design and instrument design, structure and thermal engineering, robotics, launch system engineering, orbital mechanics, integration and testing, astrophysics, and NASA programmatics among others. Initial efforts began with a quick review of the current state of art of the component technologies that contribute towards an in-space assembled telescope. Then, leveraging the collective expertise of the diverse group of experts, we formulated a reference telescope design and attempted to develop a baseline approach to modularize the telescope into components amenable for robotic assembly. The group identified different trades associated with modularization and also developed a set of criteria to discern between the different options as revealed by the trades. Based on the modularization of the telescope, we will assess the impact of various launch vehicles, orbits for assembly and operation, robotic systems and operational approaches, and other related variables. From this, a concept to assemble the reference telescope in space from modular components will be developed. Based on this concept, and definition of the modules, we will develop a mission lifecycle plan for an assembled telescope over different phases of preliminary design, detailed design, assembly-test-and-integration, and in space operations. The mission lifecycle plan will be used to evaluate cost and risk implications of in-space assembly toward answering our fundamental question of the advantages, if any, of assembling a telescope in space as compared to self-deployment. In this paper, we summarize the objectives of the study, a review of the status of the underlying component technologies, a description of the methodology, including three different multi-day technical interchange meetings (TIMs), summary of findings from the TIMs and other related activities. In addition, a detailed description of the various factors that impact in-space assembly, their interplay and criteria for discerning among them, a preliminary description of the life cycle plan, including the test and integration plan, and initial observations on cost and risk implications will be included in the paper.

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